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Confidence in the knowledge base of English language learners studying science: using agency to compensate for the lack of adequate linguistic identity.

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Abstract

Changes in the cultural and linguistic environments of learners are often associated with identity shifts. The aim of this study was to explore what identity shifts occur when science students from Bahraini national schools transition to an international university. The role of two aspects of learner identity – that is, English proficiency and science background knowledge, was examined in this study. Focus groups and semi-structured interviews were conducted with students and with university lecturers. The analysis suggested three conceptual themes of (1) Reliance on Science Knowledge, (2) The Auxiliary Role of Professional Language and (3) Adequacy of Student Learning Strategies, demonstrating what subjective meanings the participants ascribe to the interplay between science knowledge and linguistic ability. The findings suggest that despite the lack of adequate linguistic attributes, the students are still able to successfully learn science in the context of language change. It is also implied that through strategically utilising their academic background in science, students preserve their identity as successful learners from school through to university. We conclude that agency plays a separate role in transition and is not a sole function of identity. We also contest the idea of language as a necessary attribute of one's identity as it was perceived by our participants to be an advantage and an auxiliary tool rather than a requirement.

Keywords: science background knowledge • English language proficiency • identity and agency • culture change • transition

Introduction

Issues of identity and agency are commonly discussed when learners transition between culturally and linguistically diverse environments. This transition is usually described as a form of change (Hussey and Smith 2010) and it has been noted that this change may take place on a more personal level, for example, in terms of new beliefs or developmental growth, or it may involve a physical move from one place to another, such as going from primary to secondary school or leaving a home country to begin higher education (HE) abroad (Field, Galacher and Ingram 2009). In educational contexts, this change is often associated with this latter understanding of transitions, which "depicts shifts in identity and agency as people progress through the education system" (Ecclestone 2009, p. 11). This is also the definition of transition that has been adopted in this study and transition is viewed here as

changes in identity and agency as learners progress through the learning outcomes of the first year university programme at an international university established in Bahrain.

It is often suggested that in these types of transitions, identity shifts are frequently required because changes in the cultural and linguistic environment bring about negotiations of learner identity and the concern that identities shaped in one environment may not match identities required in another (Crafter and Maunder 2012). Due to this strong element of change caused by cultural diversity, transitions are often examined from various socio-cultural perspectives which emphasise the role of cultural characteristics and processes such as language, group activities, ways of acquiring knowledge and transfer of this knowledge from one context to another in forming an individual's identity (Lantolf 2000). For example, Aikenhead (2001) explored how these characteristics and processes affected the transition of Aboriginal students into Western science education and highlighted that the worldviews, identities and mother tongues of students created a significant gap between themselves and the context in which they learned science. According to Aikenhead (2001), cultural activities and artefacts known to students reduce their effectiveness when participating in a new learning community because identities that are shaped through them do not match the desired identities in the new context. This 'decreased' sense of confidence, therefore, may create many feelings of alienation and anxiety, which, in turn, affect learning science in a negative way.

Due to the culturally mixed setting of this research, we too focus on identity and its role in student participation in a new learning community. We define the case-study university and the national schools in Bahrain as two separate communities of practice, exploring which unique student characteristics shaped in the school community play a role in the new university context. Hence, the choice of the model of Communities of Practice (CoP) (Wenger 1998) as our theoretical framework. Due to our understanding of transitions and the definition of identity that we provide below, we felt that taking only these two communities of practice into account was appropriate. Looking at national schools in Bahrain as one community can additionally be justified by the distinctive homogeneity of pedagogy and programmes in those schools, which we explain in more detail under the 'Contextual Information' section.

Through exploring the student experiences with transition and the perceptions of university lecturers of this transition, we wished to advance our understanding of what identity shifts occurred when science students from national schools in Bahrain transitioned to an international university. This focus on research is significant, considering the changing landscape of HE in the Arabian Gulf, particularly due to the growth of international branch campuses in many Gulf states (Authors 2015).

Contextual Information

The students whose transition is considered in this study are all graduates from the national secondary system in Bahrain. The schools follow the national curriculum which is compulsory in all state schools, with teaching materials and pedagogical advice centralised by the government. The instruction in science and other subjects takes place in Arabic.

In recent years, Bahrain has undergone significant revisions of the national curriculum, particularly in the sciences and English as it was felt that the traditional school practices based on memorisation, inculcation and careful teacher guidance were ineffective in educating students for global competition, communication and education (Al-Baharna 2005; Hameed, Bujerry and Ahmed 2011). Culturally ingrained methods, informed by the beliefs that schools are places that should teach discipline and competency through acquiring large amounts of knowledge, were thought to be in need of revision so the future graduates could stand equal chances for competing in the developing market of HE in the Gulf and beyond (Authors 2015). It needs to be highlighted here that the student participants in this study did not study the new curriculum as they had left secondary education just before the changes were implemented. This has significance for our collusions in this paper, strengthening our claims about the power of individual agency.

The university where this study took place could be taken as an example of foreign HE institutions where Bahraini learners were perceived to face some difficulties with learning due to the traditional and carefully guided teaching pedagogies in their schools. An additional obstacle could also be found in the change of language of instruction as the programme in the case-study university is delivered in English. The university programme studied by the students in this study covers the basic sciences in biology, physics and chemistry. The teaching on this programme is delivered through big-size didactic lectures, supported by tutorials and laboratory sessions. The students who are admitted to the university from the state schools in Bahrain are top-achieving students, usually on government scholarships awarded for their achievements, with high numbers completing their graduate programmes.

As will be explained in our theoretical framework below, such cultural and linguistic changes can lead to some difficulties with learning, resulting in disturbed trajectories in identity negotiations as learners move between the two educational systems. Teaching science and English language seem to play a major role here as they are the areas of difference between the two education settings, resulting in an expectation that student experience with transition may be raptured (Crafter and Maunder 2012). This becomes particularly important, especially when we know that clear relationships between subject-specific knowledge and L2 proficiency exist and that they have a direct impact on how students acquire knowledge (Chen and Donin 1997; Usó-Juan 2006). Below, we present our theoretical framework, which helped us understand the purposeful change in student behaviour when undergoing transition to university and then we focus on the relationship between subject-specific knowledge and proficiency in a foreign language.

Conceptual Framework – CoP, Identity and Agency

CoP as a model for understanding learning was seen as particularly suitable here for it focuses on crossing boundaries – that is, discontinuities between two communities with the view to learning about the practices of the new community and to subsequently becoming its member (Wenger 1998). These discontinuities are often created by the socio-cultural frameworks of individuals (Aikenhead 2001) which, as explained above, prevent students from fully participating in learning activities of the new environment. Wenger (1998) refers to this as 'legitimate peripheral participation' and explains that on entry to each new community, learners become legitimate peripheral participants who have some experience of educational practices but who, at this periphery stage, do not know if the practices that had previously guaranteed success, and that had been valued by the members of the old community, are equally valid and valued in the new community. This links in well with what we present in the literature review about the role of students' efficacy beliefs in achieving success in learning science (Wang, Wang, Tai and Chen 2010). Thus, it seems that depending on whether or not the participants are able to transfer the practices between the communities, they might or might not become full participants (O'Donnell and Tobbell 2007).

Consequently, when this model of learning is applied to educational transitions, the learning identity of students is in the foreground because the practices of the new community require the students on the periphery to reconsider who they are as learners (O'Donnell and Tobbell 2007). The process of reconsideration is termed by Wenger (1998) as forming trajectories – that is, negotiating learner characteristics formed through culturally informed activities. If we place it in the context of identity and agency change, these negotiations seem to be the result of the struggle between existing and required learner attributes, which are undertaken by students to find a new way of being in the new learning environment (O'Shea 2013).

Identity was therefore defined in this study as distinctive attributes and characteristics of individuals which are shared by all members of a particular social group and which have been shaped through participation in common practices of this group (Côté and Levine 2002). CoP, thus, became a useful lens for conceptualising identities because the emphasis on shared community practice in this model makes it a defining force in shaping one's identity (Wenger 1998). For this reason, we rejected, for example, the understanding of identity formation through ego development (Erikson, 1968) as we considered only this identity that is born out of interactions of learners with and between culturally diverse educational environments, specifically in reference to its two characteristics – that is, the science knowledge and English language proficiency (L2).

Cupane (2011) argues that subject knowledge and professional language developed in science classrooms have the power to foster negotiations of identity in a variety of cultural contexts. Through knowledge and language, students learn to

become moderators of their characteristics and discover ways of 'staying in the world' (ibid, p. 439). This is also when they discover agency because they begin to identify how much they can do with the knowledge and language they developed in the classroom. We too decided to focus on agency in this study and we view is as 'people's capacity to interact with others and with material conditions in order to shape their own destinies' (Ecclestone 2009, p.15). Agency is understood here as the ways in which people make choices to respond to situations based on the opportunities given to them by their characteristics (ibid). This highlights the importance of understanding how science background knowledge and language interact to inform students' educational experience and we present a short discussion of this interaction in the relevant section below.

Ecclestone (2009) suggests that agency is linked to identity but, rather than being its attribute, it refers to strategic actions that can be taken because of certain attributes. This positions identity and agency as inextricably interconnected, simply because actions taken to respond to a particular context are informed by the attributes and characteristics of learners which can also serve as barriers (Ecclestone 2009). These actions, in Wenger's (1998) theory have been understood as forming trajectories, which highlights the connection between identity, agency and CoP that has guided this study (see Fig.1).

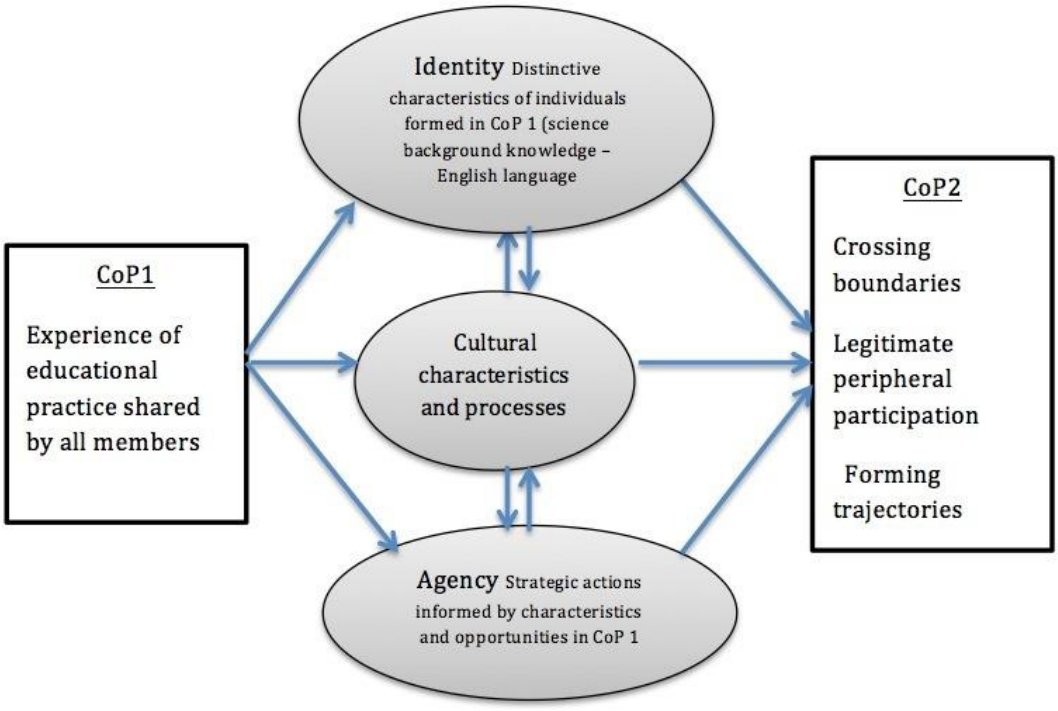

Fig.1. Conceptual Framework

Finally, returning to Cupane's (2011) claims regarding science subject knowledge and science language as important learner characteristics, we also decided to

incorporate them into our theoretical framework. It is important to note that science language will change for the learners in this study as they transition from studying science in Arabic in school to studying science in English at university. Discussion of the relationship between subject background knowledge and foreign language proficiency is therefore due, which will be briefly presented in the following section.

Subject Background Knowledge and Foreign Language Proficiency

As early as in 1980s, research on the relationship between background knowledge and students' linguistic ability in a foreign language (L2) highlighted the importance of background knowledge in disciplinary learning in that it showed that good background knowledge allows L2 students to construct meaning of the material studied (Koh 1985). It was suggested that students learn the material by utilising their linguistic skills and background knowledge of the topic and when language skills are somewhat weaker, good background knowledge allows the same students to refer to the memory of what they had studied before to still make sense of what they are studying now (Koh 1985).

Usó-Juan (2006) supported this view with the findings from her study which showed that good subject-specific knowledge enabled students to achieve higher scores on a university reading task. The participants in Usó-Juan's (2006) study were Spanish native speakers who were assigned readings in English of familiar and unfamiliar passages in order to measure the effects of background knowledge on their test performance. The results from the study revealed that students who read familiar passages outperformed students with unfamiliar texts.

Research by Chen and Donin (1997) offers additional support for the findings by Usó-Juan (2006) and implies that the higher the levels of background knowledge, the higher the possibility that the compensatory effect of subject-specific information on language skills will occur. Both these studies also indicate that English-language proficiency is a more powerful factor than discipline-related knowledge through citing evidence suggesting that only participants with advanced and intermediate levels of English were able to use subject-specific knowledge for compensation. Usó-Juan (2006) claims that it is necessary for the participants to reach a specific linguistic threshold level in order to be able to read academic texts and learn the academic content with understanding.

These conclusions support Cummins's (1981) theory of 'linguistic threshold' which maintains that language learners studying in disciplinary areas need to attain specific levels of foreign language proficiency in order to study more effectively. This bears significance to the literature on English language education in Bahrain which puts the national system and teacher competencies under some scrutiny, suggesting that graduates from national schools present low English language proficiency and are underprepared to perform well in higher education (HE) (Abdulmajeed 1995, Al-Ahmed 1994). We also highlight this significance in our

theoretical framework by focusing on English language proficiency as a distinctive characteristic of our students' identity, which has been shaped through common practices of English language teaching in the state education system in Bahrain. We therefore explore the role of the students' English language proficiency and science background knowledge in this study, trying to understand, through the lens of CoP, how our students negotiate their identities when crossing boundaries between the communities of their schools and the university at which they currently study.

Wang et al. (2010) claim that prior science knowledge and L2 proficiency are two very important traits that play a major role in acquiring the scientific material to be studied. Their findings suggest that learning science in a new setting is a complex process in which "experiences and information are processed through the lens of a learner's comprehension of science language, epistemological beliefs, efficacy beliefs and metacognitive skills" (ibid. p. 803). While the studies by Usó-Juan (2006) and Chen and Donin (1997) cited above can be very illuminating in identifying the relationship between subject-specific background knowledge and L2 ability, we felt that gathering perceptions of the role of English language proficiency and science background knowledge in students' identity and agency change was more appropriate. Following Wang et al. (2010), we wished to advance knowledge of the role of communities of practice in transitions, through exploring the complex interplay between L2, science knowledge and academic success. Students' efficacy beliefs about themselves as capable learners in HE were particularly important here, seeing that CoP seem to emphasise that these capabilities of learners could be pre-defined by their communities. We also focused on the perceptions of the university faculty to explore their epistemological beliefs about the role of student identity in learning science in HE. We posed the following research questions:

(1) *What is the role of students' English proficiency and science background knowledge in how they perform at university to achieve the educational outcomes of the first year programme?*
(2) *How do the students and university lecturers perceive the role of English language proficiency and science background knowledge in identity and agency change as they transition to a new learning community?*

Materials and Methods

As argued in the theoretical framework, this study adopts social-cultural constructivism as its theoretical framework. In this sense, we argue that we can study human activities (e.g. transition) through culturally constituted conceptual or epistemological frameworks, enabled and limited by local cultural features such as discursive practices, institutional structures, interests, values and cultural norms (Author 2013). In this study and by using social-cultural constructivism, we interpret the participants' science learning situations considering the broader social system in which the learning is happening and will draw interpretations about an individual's

thinking and development based on his or her participation in culturally organized activities. In addition, we consider the individual and the ways in which sense making happens through the individual's accommodation of experience when studying science in different linguistic contexts (Cobb, 1994). This was reflected in our research questions which were designed to explore our participants' experiences with transitions considering their linguistic-socio-cultural contexts in which the individuals have been brought up. This also links in well with our data analysis approach and the theoretical framework in which we focused on the participants' interpretations of transitions from two different CoP, which were analysed concurrently (see Figure 2).

A single case-study methodology was therefore designed. Using Yin's (2012) definition of a case as a social phenomenon bounded within an organisation, we defined our case as transition of Bahraini students to an international university. This transition was analysed in terms of the perceived role of science background knowledge and the English language in identity and agency shifts. Our case, therefore, was analysed in terms of two essential issues (Yin 2012), namely (1) the role of background knowledge and (2) the English language as characteristics of student identity, which required a top-down approach to data analysis, but with added emphasis on participant views. This was best reflected through the 'Definition of Situation' approach discussed in the relevant section below (Bogdan and Biklen 2003).

Sampling

Purposive sampling was applied to select student participants as we were interested in students from national schools in Bahrain studying in the first year university programme. At the time of the study, there were 60 Bahraini students registered with the university. The eligibility criteria for participation in the study included the following: (1) all students were first year university students, (2) all students were Bahraini, (3) all students graduated from the Bahraini mainstream state education system (4) all studied sciences in Arabic at the school level and (5) all students were native speakers of Arabic. After applying these criteria, 41 students were eligible to participate. 35 students out of these 41 agreed to take part in the research. Student participants were coded according to those who attended the English programme at the university (ELC) and those who were exempt from this programme (Non-ELC). The threshold level of IELTS 6.5[1] is used by the university in allocating students in the English programme as students at this proficiency level are believed to be competent language users and therefore do not need additional linguistic help. It is internationally accepted that the linguistic threshold of IELTS 6.5 does not affect students cognitive ability as suggested by Cummins's (1981) 'linguistic threshold

[1] IELTS stands for the International English Language Testing System and the score of 6.5 describes a competent English language user who is able to cope with the language demand when studying a discipline in a foreign language.

theory' cited in the literature review. This distinction in the research was important to argue if students with lower English proficiency experienced more or different problems with studying science at university and to draw conclusions in terms of the role of the 'linguistic threshold' (Cummins 1981). Students were interviewed in four separate focus group sessions, 2 groups consisted of ELC students (n=10 and n=12) and their responses were coded, for example, *ELC Student 1*, and two groups consisted of Non-ELC students (n=7 and n=6) whose responses were coded, for instance, *Non-ELC Student 5*.

All lecturers (n=6) who deliver the curriculum in the FY also took part in the study. They were all male, educated to a PhD level and their teaching experience ranged from 8-50 years. The material that they teach covers human systems, medical physics, medicinal and pharmaceutical chemistry, human biology and disease. We were interested to gain their perspectives on how the demand of studying science in their classes might affect English language learners. Their responses were coded using numbers 1-6, for example *Faculty 1* or *Faculty 2*.

All participants were informed about the purposes of the study and that their participation was voluntary. They were also allowed to withdraw at any point of the study. The authors ensured that the research was not harmful to any participants involved in this study. The authors obtained ethics approval from Exeter University and fully followed the Committee on Publication Ethics (COPE) guidelines when carrying out the research and preparing it for publication.

Data collection

Focus groups were chosen to collect data from the students because this method originated in the idea of interviewing people who were known to have shared a certain experience to explore their thoughts about that experience (Anderson 1998). Interviewing, as opposed to other methods of data collection, was viewed as the most adequate because this form of data collection reveals how case study participants think about certain situations (Yin 2012), and participant perceptions were part of our research questions. We also believed that using focus groups was very valuable in researching the role of science education in the Bahraini context because, as Thomas (2008) argues, the use of this form of interviewing is suitable for researchers who engage in exploring Arab cultures due to the social collectivism that characterises these cultures. This means that participants in focus groups are likely to present common, collective experiences because the level of trust between in-group members is likely to be high. We believe this strengthens our evidence in the results section, representing views of the majority of participants. On the other hand, we fully acknowledge that high levels of collectivism may also present limitations to the study in that individuals might feel reservations in expressing views that are different from the majority in the group. To deal with this limitation, we offered the participants the opportunity to comment on the draft reports of our analysis. No comments were returned.

The students were interviewed in two rounds. In the first round of focus groups (4 separate focus groups sessions with two ELC and two Non-ELC groups), the students were asked to compare learning science at university with learning science at secondary level in terms of the material covered and pedagogy. Ten interview questions were prepared and they focused on the specific requirements in the university's content classes and how they compared to the requirements at secondary level. In the second part of the interview, the participants were then asked to elaborate on how they felt about their English language abilities in relation to these requirements. Exploring these questions with the students was believed to help us answer the research questions in that it would indicate how the students felt about their efficacy skills, in science and in English, and how much change they required from them when at university. This change was particularly explored in the second round of student interviews, through questions about the level of preparation for university by the pedagogical culture of Bahraini schools. This was significant for the theoretical framework as if focused on the context of schools and the university as specific communities of practice.

This focus was perpetuated in the semi-structured interviews with the lecturers, which were conducted separately with each faculty member (n=6). The faculty were asked to discuss their expectations and importance of good English language skills for the core subjects delivered in the first year and the specific demands in these subjects in terms of science. The final questions also explored whether the university faculty thought that the culture of learning in Bahrain might have had any consequences for students' careers at university. This helped us draw conclusions in terms of the degree of student identity change and school and university factors that might have necessitated this change. The list of the questions used in the two rounds of focus groups can be viewed in Appendices 1 and 2. The questions explored in the semi-structured interviews are listed in Appendix 3.

The focus group and the semi-structured interviews were audio recorded and all interviews were conducted on the university campus. All interviews with the science lecturers and students were conducted in English but the interview protocol and questions for students were back translated from English into Arabic. Each student interviewee was given a copy of the interview protocol with questions written in both languages and lecturers were given copies only in English as it is their first language. On average, the interview sessions lasted between 40 - 60 minutes.

Data analysis

The 'Definition of Situation' approach directs the researchers' attention to concepts that reflect participants' own concerns, which was reflected in our research questions, but it also focuses it on the essential issues investigated in the study (Bogdan and Biklen 2003). The essential issues that were investigated in this study were related to the English language and science background knowledge developed in school, which were permeating data analysis and guiding their interpretation. In organising the data, the aim was to always place units of data under either the

English language or science background knowledge. This approach to data analysis was applied to all participant groups and themes were derived in relation to English language and science background knowledge within each group (Bogdan and Biklen 2003). These themes were then interpreted in relation to identity and agency shifts in the discussion section.

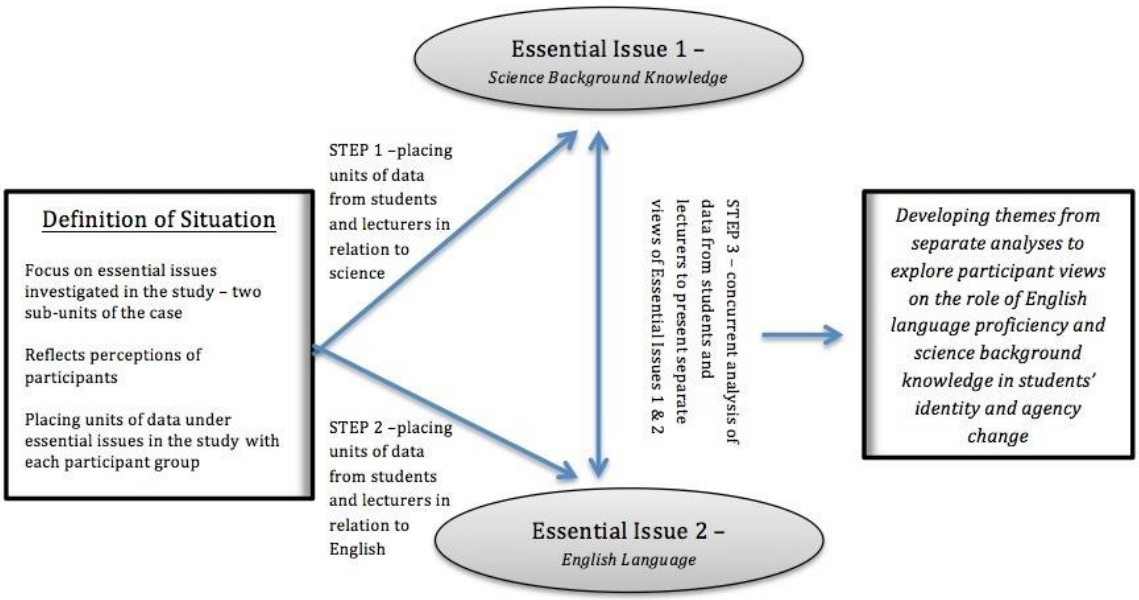

Fig.2. Procedures of Data Analysis

For analysis, all interviews were transcribed in full. After the initial organisation of data under the science background knowledge and the English language, segments of text were summarised with key words developed during the reading of the transcripts. Individual text segments were then grouped together within either the Essential Issue 1 or the Essential Issue 2. For example, text segments coded *'studied previously in school', 'helps with learning in English'* and *'strong science'* were placed under Essential Issue 1 (Science Background Knowledge). They were then interpreted in terms of addressing the research questions (Yin, 2012) and a theme of '*Reliance on Science Content*' was developed. The same procedure was involved in developing two other themes of *'The Auxiliary Role of Professional Language'* and *'Adequacy of Student Learning Strategies'*.

We used theme descriptions of properties, processes, dimensions and modes for understanding the consequences in the development of our themes proposed by Wilson Scott and Howell (2008). Wilson Scott and Howell (2008) propose that these descriptors help to organise data in a way that sufficiently describes what the theme means. The 'process' descriptor refers to action, which under the theme of *'Reliance on Science Content'* described any instances in the data which referred to utilising background knowledge for learning. The descriptor of 'properties' refers to

characteristics of the themes, and for us, it was used to indicate confidence with which the students used their background knowledge. 'Dimensions' locate the property on the continuum and this descriptor was applied here to gauge how the participants felt about the importance of background knowledge. Finally, the 'modes for understanding the consequences' described how the confidence in background knowledge facilitated the transition process as they generally apply to process outcomes in qualitative analysis (Wilson Scott and Howell 2008). Taking into consideration that the process of forming trajectories was a significant element of our theoretical framework, the 'process' description was the most meaningful for us. Hence, for example, the code of 'translation' was placed under the theme of 'Reliance on Science Knowledge', as opposed to 'Role of Professional Language', as this reflected a specific process strategy born out of strategically using the background knowledge.

The research was conducted in two concurrent stages: stage one involved interviewing students in two related-rounds of focus groups and stage two involved interviewing science lecturers at university. Individual transcripts were coded by all researchers and their codes were compared to agree the final themes. The first author collected all data in this study.

Results

Tables 1 and 2 below present individual codes, categories and themes from each participant group, covering all data. Three conceptual themes were identified between students and university lecturers in relation to the English language and science background knowledge. These categories included: (1) Reliance on Science Knowledge, (2) The Auxiliary Role of Professional Language and (3) Adequacy of Student Learning Strategies.

Table 1: Codes, Categories and Themes derived from student participants data

Theme	Category	Codes
Reliance on Science Knowledge	*Good Background*	studied previously in school; helps with learning in English; strong science
	Translation	translating from Arabic; helps in identifying words; increased time of study; know it in Arabic;
Auxiliary Role of Professional Language	*Lack of Medical Terminology in English*	value of medical terminology; impacts study time; general proficiency not important; students need medical terminology
	General proficiency	difference in language skills now; not able to write freely; writing needed for exams; important to write clearly

Table 2: Codes, Categories and Themes derived from university lecturers data

Theme	Category	Codes
Adequacy of Student Learning Strategies	*Individual study techniques*	translation; students translate at university; translation works at university; high achievers use the same study techniques
	Adequacy of Memorisation	students memorise; memorisation leads to understanding; good students memorise; students learning at university based on memorisation
	Awareness of the Language Impact	can be more difficult for low language users; English not a major factor; Tawjihiya students very successful despite low English; top students from Bahraini schools where English is low
		English impacts translation; loss of information; dominance of language, time consuming
		accuracy not important; key words; spelling not important; demonstration of knowledge; marks for effort; language mistakes do not impact marking

(1) Reliance on science content

The responses collected under this category revealed that good science base enhanced student understanding of the lecture content and helped them overcome language barriers because, as the majority of students explained, "*The science at school was so strong" (Non-ELC2 Student 1) and* "*because we took it in Arabic, I [only] have to study it in English, but it's good, at least you have a background" (ELC 1 Student 6).* The reliance on the science content was therefore demonstrated here through consciously linking the new material to the material studied in school, which was also a useful resource facilitating the process of studying in English.

> *Non-ELC 1 Student 5*: The basics of sciences, we have it from school. So we are just relearning it now in English. We are learning new things as well and we are connecting between what we learnt at school, and maybe we learnt something at school not from the basics but we are learning again from the basics. Or we learnt something with the gap and now we are filling the gap.

For many students, discovering that they could rely on the background knowledge seemed to have facilitated a specific way of learning, which was based on translating the lecture content. Non-ELC2 Student 3 explained that:

Non-ELC2 Student 3: *We have studied all the material that was given but it was in Arabic, so now, when I'm translating, I am just using the dictionary and then I go 'Oh, that's that one*'.

The increased understanding of the scientific concepts after translation seems to suggest that the background knowledge played a big role in how the students coped with the language demand. This was particularly highlighted in reference to state-run schools, when many students compared their experiences with learning at university with the experiences of their colleagues from private schools. They indicated that their colleagues from private schools who received education in English, but perhaps had lower levels of scientific knowledge, were more disadvantaged at university.

ELC1 Student1: I think that in a government school there is a very strong point for anyone who want to enter the university, it would be easier for him if he was in government school. Especially in the biology, in the first semester we took the insects etc., it was very detailed, so it wasn't hard for us.

Researcher: Do you feel disadvantaged because you didn't come from a private school?
Non-ELC2 Student 1: Yes and No. Yes, because I'm not that good in English, but no because of some of the background I have in sciences, I took it in public school and when I ask people from private schools about the whole thing, they just say they didn't take that.

(2) The auxiliary role of professional language

Despite viewing science background knowledge as their strong point, many students felt that language was still a factor in their transition. For instance, the students who attended the medical terminology classes run by the university discussed the positive effects of these classes on their understanding of the material:

ELC1 Student 2: ELC[2] is useful, like for the medical terminology. Even the pre-sessional[3], when I came here, I wasn't used to studying scientific things in English. I had to use the dictionary first but now I'm OK.

It seems, however, that the students ascribed importance to only this language that facilitated the translation process. All students expressed similar views to the ELC1 Student 2 above, placing emphasis on professional terminology as opposed to general English proficiency. Students in both, the higher language and lower language groups explained that it is:

[2] ELC stands for English Language and Communication classes offered by the university
[3] Pre-sessional Course in English is offered to students prior to their start in Foundation Year. The materials used in this course are based on the learning objectives of the core subjects in the FY.

Non-ELC2 Student 2: Because everything is clear, we are just taking the basis from the lectures, so we don't really have to go to other references because it's just the basics, just the foundation.

The theme that strongly emerged from these conversations was that knowledge of professional language had mainly an auxiliary function, indicating that it was an advantage and that it was useful in supporting the strategy of translating the lecture content. All students highlighted in conversations that because it is "*just the foundation*", the students can learn the material through translation and their understanding of lecturers is not affected. The students seemed to have developed an increased sense of ability through discovering that the lecture content could be memorised when translated and stated that '*when you come to the exam, you feel confident' (ELC2 Student 3)*. For this reason, the majority of them felt that:

Non-ELC1 Student 3: it helps but not a lot. Like a lot of people have excellent English language but they will not score as high as the others. It is important, the English language but it's not the key to success.

The combination of these findings with the confidence about students' background knowledge in science suggests that language might have been a barrier to performance in exams, rather than to understanding the lecture content:

Non-ELC2 Student 3: (…) because to answer the question you must write it in your own words. So if you don't have the ability of writing in English, you will have a big problem"

Non-ELC2 Student 5: You may understand the idea but you couldn't transfer it to the other end and the doctor misunderstands it and you will lose your mark and you know the answer.

ELC1 Student 3: For me in the first semester, I know the answer but when I wanna write it, it twists my tongue, I don't know how to put the information or translate. This kind of simple things is affecting us.

(3) Adequacy of student learning strategies

Despite these difficulties with the English language, the faculty at university reported that students are still able to transfer what they learnt in their Arabic curriculum and simultaneously perform at the level of language and knowledge required at university because they '*worked out their way of doing that and what they are doing is translating English into Arabic and back' (Faculty 5).*

Faculty2: When I look at the list of high achievers I rank them based on the raw results, there are plenty of high achievers who've come to us with scholarships from Tawjihiya[4] for instance, who are high achievers as well. They have been able to make that transition almost seamlessly and I often ask them and it seems that what has

[4] Tawjihiya is the qualification awarded on completion of national secondary education; the science material is delivered in Arabic.

> worked for them in secondary school also works for them here. Obviously they are making some adaptations but they seem to have all the tools that are required to remain high achievers here.

The faculty additionally stated that they do not think that students' problems are related to the low proficiency of the English language. *Faculty5*, for instance, stated that:

> *Faculty 5: They might be weak in the English language but I don't believe that that's one of the major factors. I don't think that that's happening because of the English language.*

The lecturers agreed that low English proficiency students are still able to transfer the science knowledge in a way that:

> Faculty 4: *you can make sense of it and you know that they know their stuff, they're just not physically able to write it down properly because they don't have good grammar etc.*

All university lecturers also agreed that poor language skills do not stop students from providing the required answers during assessments.

> *Faculty2*: If I see a blank page and I say 'What's the issue there?', they don't say because I don't have a perfect answer and I haven't written it down, they quite happily admit that they know nothing so they put nothing down, so again I don't think there is any hidden meaning behind that, if they knew the material, they would put it down. Very very seldom I see students that say 'I knew three quarters of it but I didn't put it down because I wanted to have a perfect answer. What we're discussing here, 99 times out of 100, if the information isn't put down, the information hasn't been there in the first place.

Even though the faculty agreed that translating and memorizing is something that students should not be doing because *"it's the language that becomes dominant and the idea is lost" (Faculty 1),* by doing this, a successful student still "*has some key words that are necessary to demonstrate an understanding but those key words are not necessarily in the right place" (Faculty 5)*. Faculty 2 stated that "*sometimes the structuring of sentences can be very poor but the presence of key words indicates that the students have understood the material" (Faculty 2).* Faculty1 supported this observation and added that we "*shouldn't stigmatise students with low English because some Tawjihiya students are excellent and graduate with first class honours*"*(Faculty 1).*

Discussion

The discussion of the research findings in earlier sections of this article related to the compensatory effects of subject-specific knowledge on students' linguistic ability, suggested that language students with good background knowledge experience

fewer difficulties in learning the subject material in the new context because they can refer to the memory of the material studied before (Koh 1985). The findings presented in this study imply that this should also apply to the students beginning third level science education in this research. The confidence of these students and the university lecturers in the levels of science background knowledge that the students brought with them from school and the study methods they used to utilise this knowledge, suggested that Bahraini learners were able to compensate for the weaknesses in English proficiency by referring to their background knowledge in science. The interviewee comments indicated that, in their view, the movement through the educational outcomes of the university programme might have been eased because Bahraini students entered university with background knowledge in science that is transferrable to university. Additionally, the responses collected from the students also revealed that all students in this study regarded this area as their strong point.

As shown in the results section above, good bases in science were reported by the students to enhance their understanding of the lecture content and to help them overcome language barriers because they could relate to the memory of what they had studied in Arabic, after translating the lecture notes. University faculty additionally substantiated this view by agreeing that, despite the greater depth of the material required in HE, the students were still able to transfer what they learned in their Arabic curriculum and simultaneously perform at the level of language and knowledge required at university.

This confidence in science background knowledge implied that transition to university was enhanced because the students did not have to engage in many negotiations between existing and expected learner attributes (O'Shea 2013). The students in this study came to realise that strategically using their background knowledge in the translation process did not require them to engage in forming new trajectories, avoiding in this way what otherwise could be regarded as an overwhelming process of identity negotiation. Through analysing the students' comments we came to realise that the role of science background knowledge in transition was extremely positive, building a greater sense of student agency and spanning school identity into an identity of a successful university student. This was particularly strong when students and university lecturers talked about the transfer of science knowledge through techniques that were developed in response to the lack of appropriate language attributes.

López-Facal and Jiménez-Aleixandre (2009) refer to attributes such as language skills and subject-knowledge as "socio-professional identity". They argue that this identity develops in educational institutions and that it is constructed through a process which in our theoretical framework has been identified as crossing boundaries. López-Facal and Jiménez-Aleixandre (2009) seem to support Wenger's claims about the impact of the practice within a community on forming trajectories and suggest that changes of identity are almost inevitable in transitions. Our data

seem to suggest a slightly different view on the importance of negotiating the 'socio-professional identity' when crossing boundaries. We would like to argue that, through perceiving the subject-knowledge as a positive attribute that could compensate for the negative role of the lack of language, our participants presented a more 'undisturbed' process of transition.

The students in this study seemed to have felt that their dispositions and attributes as learners who have strong knowledge in science enabled their participation in the new community and that their past dispositions were not challenged by the expected norms during the transition. This seems to have increased their sense of agency. The fact that the students felt that only small adaptations in the strategic actions used to learn the science material in the past had to be made in order to cope with the present demands at university, reinforced the students' images of self as capable learners. This was also strongly emphasised by the lecturers who confirmed that the strategies developed in school through memorisation and inculcation also guaranteed success at university, as students could continue to study in the same ways through translating the lecture content. We propose therefore that the role of science knowledge was positive in that it allowed students to enter the new community with an increased sense of agency, reducing in this way the need for identity negotiations. This also has additional implications for the theoretical framework adopted in this study.

The theoretical framework underpinning this research recognises that the practices that shaped learners' characteristics and ways of acquiring knowledge that guaranteed success in one community may not be transferable to another, suggesting that former learning identities prevent students from moving from the periphery to full participation, making transitions ineffective (Crafter and Maunder 2012). While the majority of research adopting this framework for understanding transitions demonstrates a rather negative impact of these practices on this move (e.g. O'Donnell and Tobbell 2007), the data collected here imply that the role of these practices was diminished by high levels of students' confidence about themselves as capable learners. This suggests a slightly different angle for looking at transitions. The identity of students did not seem to be at the forefront of the transition studied here but it was rather related to student strategic action of using the background knowledge. We propose that students developed the strategy of translating the lecture content so they could use the same strategies as in school, supported by the strong attributes of their identity, which seems to be the background knowledge. But rather than being a function of identity, agency was more powerful in this transition as it was strengthened by confidence in background knowledge rather than being the ability dependent on identity.

The students in this study clearly used their background knowledge to compensate for the lack of linguistic proficiency. These findings seem to be in keeping with the majority of results from academic studies presented in the literature review which highlight the compensatory nature of subject-specific knowledge on

language deficiencies (for example: Chen and Donin 1997; Usȯ-Juan 2006). However, what we consider to be a novel finding is the fact that rather than being a necessary attribute of one's identity, knowledge of professional language was perceived by the students and the lecturers to be an advantage and an auxiliary tool that was used to facilitate the transition process. Based on these findings, we would like to conclude that the role of the English language in how the students negotiated their identity was minimal and that it did not have a negative impact on the increased sense of agency built by the science knowledge.

In this study neither strong nor weak language students reported difficulties in acquiring the subject material, which was reflected in the comments from the ELC and Non-ELC groups. This challenges a substantial number of findings in academic literature that focus on the relationship between background knowledge and language proficiency (e.g. Koh, 1985; Chen and Donin 1997) and lends greater support for the auxiliary role of language proposed by this research. Student suggestions from the ELC and Non-ELC groups about their general language proficiency as a factor in transitions conceptualised, on the other hand, more deeply the distinction between the Cognitive Academic Language Proficiency (CALP) and Basic Interpersonal Communicative Skills (BICS), contributing to already existing conclusions that it is CALP that is applied by learners in academic settings (Cummins 1981). CALP includes the use of professional disciplinary language developed in academic settings, which for the students in this study meant knowing the professional terminology and having disciplinary writing skills. The lecturers additionally highlighted the role of CALP by acknowledging that the knowledge of professional key terms and the skilfulness in using these key terms to explain scientific concepts in English, rather than correctness of sentences, played a more positive role in transition. They did not, however, suggest that CALP was a required attribute of student identity because as indicated by all participant groups in this research, when intersected with science background knowledge, professional language was only used in auxiliary terms. This answers our research questions in that it suggests that the role of the English language was perceived to be unimportant in the transition process. This process was on the other hand catalysed by the increased sense of agency – that is students' greater ability to take on the challenge of transition because they had confidence in their science knowledge.

Our findings suggest that students can be very proactive about the lack of the required linguistic identity and that they are able to find alternative resources for their success. It also seems that the students in this study sought alternatives that required little shifts in identity, as opposed to trying to change it in a way the new community might have imposed it on them. The lecturers suggested that what the students were doing was not a preferred way of learning at university but it allowed them to study the material in the same way as they would in school. We would like to suggest that having this confidence facilitated their movement from the periphery towards the centre, allowing the students to transition as peripheral participants who

were undeterred by the practices of the new community that required higher L2 proficiency. This seems to suggest that placing identity in the forefront of transitions may not be adequate because it does not allow for considerations of what learners can do with their individual agency to overcome problems with 'inadequate' identity. This therefore raises the need for more work in understanding transitions, focusing on the possibility that students may develop their own practices that do not require forming new trajectories when L2 might be an issue. We also acknowledge that the didactic nature of programmes at the university could play a role in this transition and that the strategies adopted by our students might be challenged when they move to more senior years. This might present a change to the perspective on the 'linguistic threshold' theory (Cummins 1981) presented here as compensating with background knowledge for weak language proficiency may not be possible when students study higher levels of science.

Conflict of Interest

The authors have no conflict of interests to declare.

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Appendix 1 – Focus Groups Questions – Students (Round 1)

1. How do you feel about studying at the university now? How is it different from school? What's hard? What's easy?
2. Do you think your English classes helped you with studying other subjects? Why/ Why not?
3. Can you think of anything specific that you learnt in the ELC [English language classes] that you later used for reading/ writing/ grammar/ medical terminology or any other activity in your other subjects? Describe please.

4. How do you feel about learning grammar, reading and writing now at university? Do you think it's important to improve it? What are your goals in improving those skills?
5. What was learning English like at school? Can you compare it to what is needed now at university?
6. Were the tasks at school similar to what you've done this semester? In what ways were they similar/ different?
- In English
- In Sciences
7. Do you do any reading in your content classes? [think about examinations, lecture preparation, extra reading] Do you find it hard? Easy? Is it the same to the tasks at school?
8. How about grammar? Is it important for your content classes?
9. When you think about the academic skills you need now to be a successful student, what are the most important?
10. Were those skills practised in school? Do you think that the school prepared you well for studying at the university?

Appendix 2 – Focus Groups Questions – Students (Round 2)

1. We have already discussed the effects of schooling on your transition to university and you talked about science and language issues, as well as study skills, etc. This time I would like you to tell me about personal changes that you had to undergo in order to adapt to the university environment.

2. What aspects of Bahraini culture in schools play a role in making a transition to a university like this one?

3. Do you feel you have undergone any major changes in identity/ agency [any intentional changes in your ways regarding dealing with your studies] in order to be able to study at this university?

4. Do you feel that being in Bahraini schools has pre-disposed you as to how you view/ approach things now? Has anything changed? And if yes, was it difficult to change?

5. Could you talk about your attitude towards learning before coming to university and compare it with the way you view things now?

Appendix 3 – interview Questions – University Faculty

1. What in your view are the biggest problems with learning FY students face?
2. What are your expectations in terms of the English language? Do you verify the correctness of language in your classes? For example, do you mark it on examination papers?
3. In terms of reading and writing, what types of tasks are required in your content classes? What are the specific demands of those tasks? What is evaluated?
4. Are good reading and writing skills important for your subjects? In what ways?

5. What are your expectations in terms of other skills students should develop to achieve success in your subjects?
6. Are those skills verified in formal assessment? Are they included in the examination questions?
7. What do you think about the quality of students? What do you think about the quality of their assignments? What are the strengths/ weaknesses? Why do they fail?
8. How can students better prepare for the requirements in your content classes?
9. Is there anything you'd like to add?

Title: Confidence in the knowledge base of English language learners studying science: using agency to compensate for the lack of adequate linguistic identity.

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Abstract

Changes in the cultural and linguistic environments of learners are often associated with identity shifts. The aim of this study was to explore what identity shifts occur when science students from Bahraini national schools transition to an international university. The role of two aspects of learner identity – that is, English proficiency and science background knowledge, was examined in this study. Focus groups and semi-structured interviews were conducted with students and with university lecturers. The analysis suggested three conceptual themes of (1) Reliance on Science Knowledge, (2) The Auxiliary Role of Professional Language and (3) Adequacy of Student Learning Strategies, demonstrating what subjective meanings the participants ascribe to the interplay between science knowledge and linguistic ability. The findings suggest that despite the lack of adequate linguistic attributes, the students are still able to successfully learn science in the context of language change. It is also implied that through strategically utilising their academic background in science, students preserve their identity as successful learners from school through to university. We conclude that agency plays a separate role in transition and is not a sole function of identity. We also contest the idea of language as a necessary attribute of one's identity as it was perceived by our participants to be an advantage and an auxiliary tool rather than a requirement.

Keywords: science background knowledge • English language proficiency • identity and agency • culture change • transition

Dear Dr Corrigan,

RE: Manuscript RISE-D-14-00161R1

We are pleased to attach the final revisions for our manuscript 'Confidence in the knowledge base of English language learners studying science: using agency to compensate for the lack of adequate linguistic identity' to RISE.

I confirm that the reference on p. 10 has been added and that the word 'translation' has been replaced with 'transition'.

We are delighted at the acceptance of this article.

With best wishes,

Aneta Hayes and Nasser Mansour